

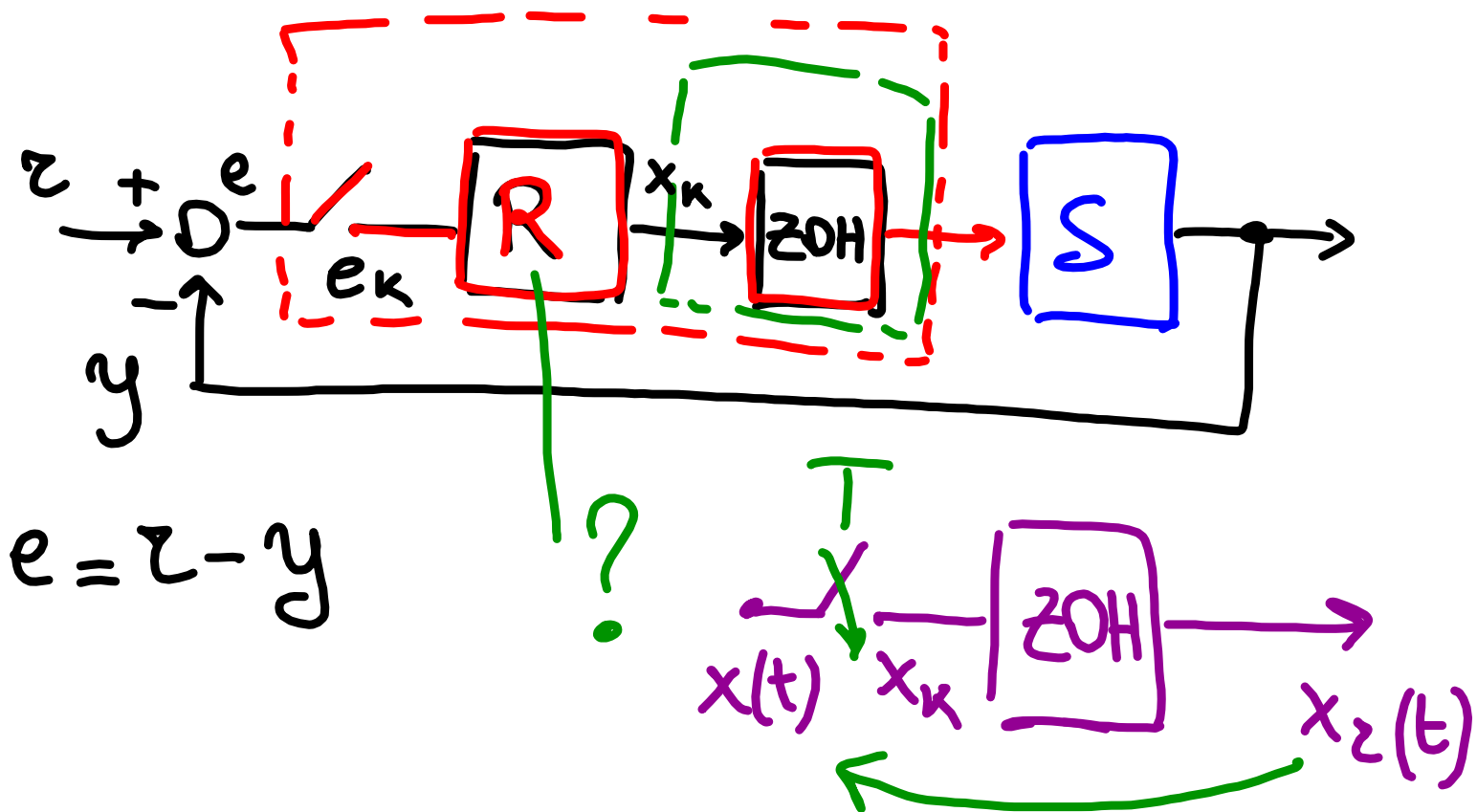
$$x_n = \frac{1}{2\pi j} \oint_C X(z) z^{n-1} dz$$

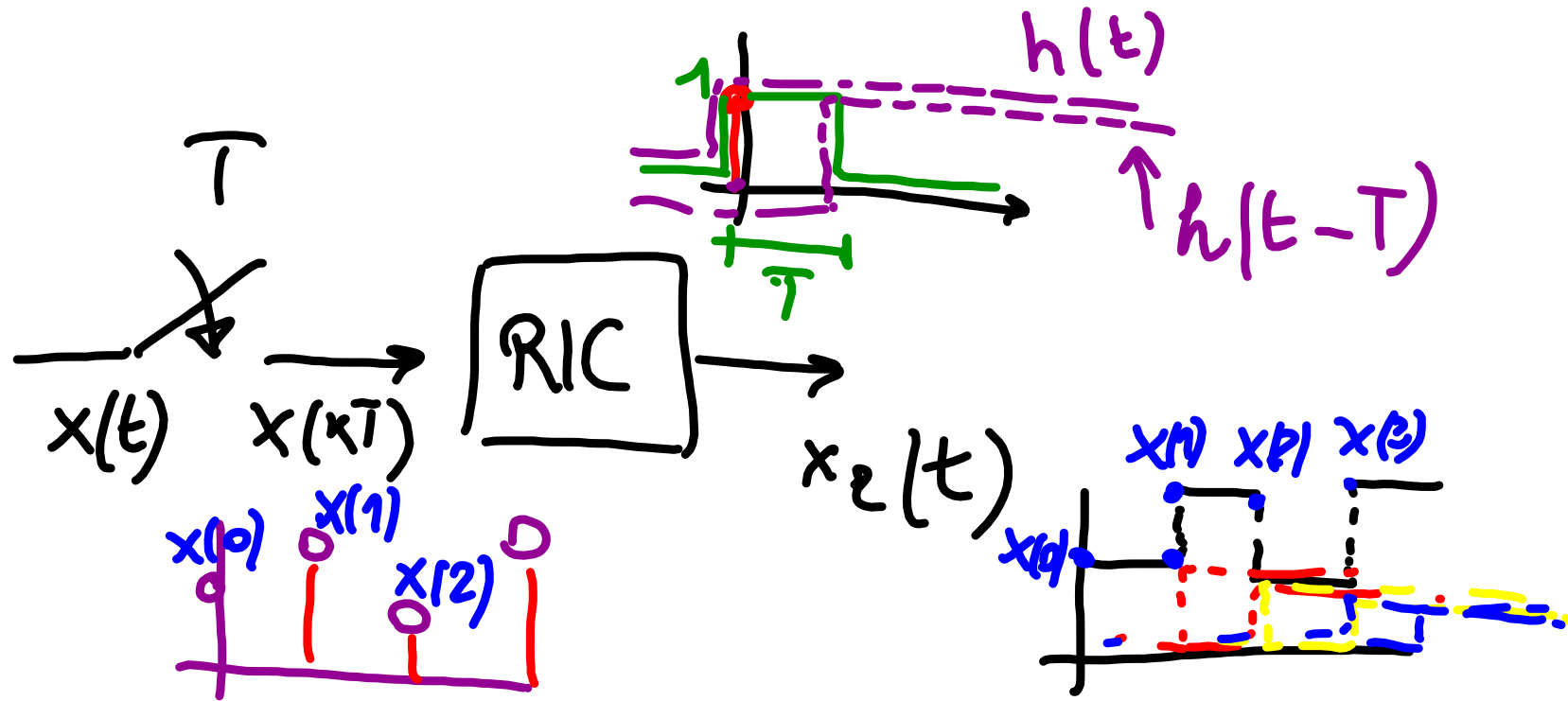
$$\frac{X(z)}{z} = \sum_{k=1}^n \frac{c_i}{z - p_i}$$

$$\frac{Z[a^k]}{z} = \frac{1}{z - a}$$

$$\frac{c_i}{z - p_i} \rightarrow c_i p_i^k$$

$$y(t) = \sum_{k=1}^n c_i e^{-p_i t}$$
$$c_i e^{-t/\tau_i}$$





$$x_2(t) = \sum_{k=0}^{+\infty} x(kT) \left[ h(t-kT) - h(t-(k+1)T) \right]$$

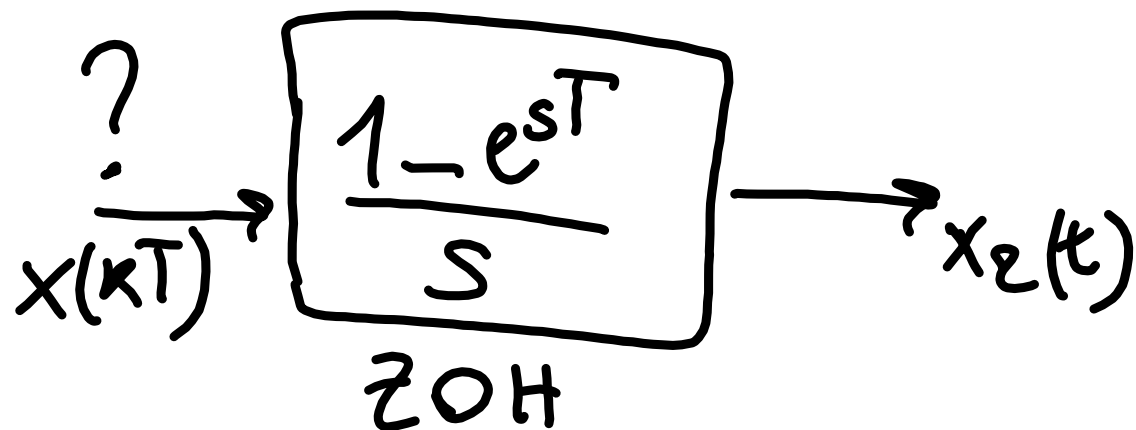
$x(kT)$   
 $x(kT)h(t-kT)$   
 $x(kT) \cdot h(t-(k+1)T)$

$$\begin{aligned}
 X_2(s) &= \int_0^{+\infty} \left[ \sum_{k=0}^{+\infty} x(kT) \left[ h(t-kT) - h(t-(k+1)T) \right] \right] e^{-st} dt \\
 X_2(s) &= \sum_{k=0}^{+\infty} x(kT) \left[ \left( \frac{1}{s} \right) e^{-kTs} - \left( \frac{1}{s} \right) e^{-(k+1)Ts} \right]
 \end{aligned}$$

$$= \sum_{k=0}^{+\infty} x(kT) e^{-kTs} \underbrace{\left[ \frac{1 - e^{-Ts}}{s} \right]}_{H_2(s)}$$

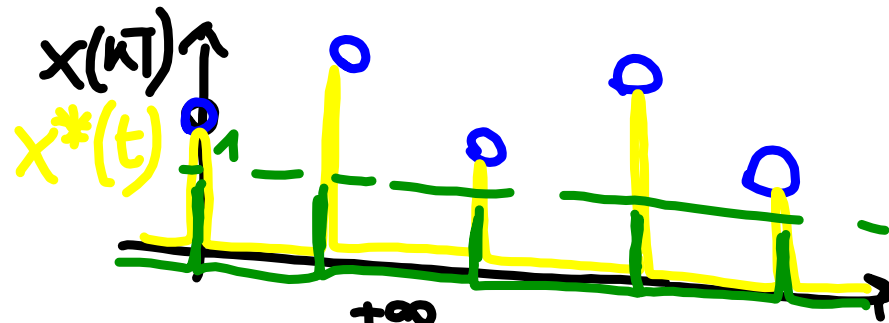
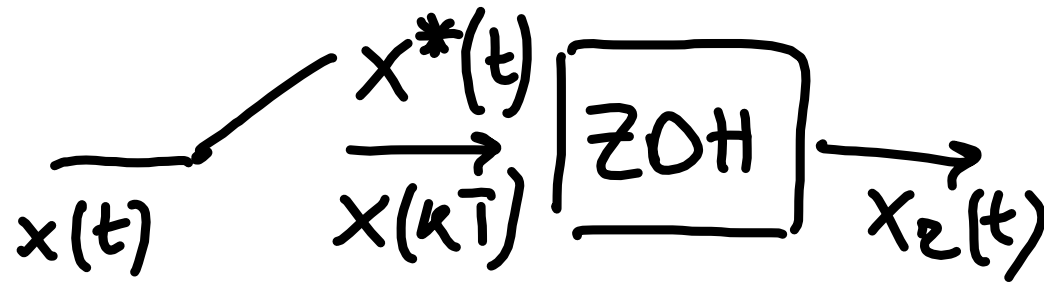
$$X_2(s) = H_2(s)$$





$$X_e(s) = H_e(s) \cdot \left[ \sum_{k=0}^{+\infty} x(kT) e^{-ks} \right] \cdot \left[ \frac{1 - e^{-sT}}{s} \right]$$

$X_e(s) = H_e(s) \cdot \left[ \sum_{k=0}^{+\infty} x(kT) e^{-ks} \right] \cdot \left[ \frac{1 - e^{-sT}}{s} \right]$



$$x^*(t) = \begin{cases} x(kT) & t = kT \\ 0 & \text{altrove} \end{cases}$$

$$x^*(t) = \sum_{k=0}^{+\infty} x(kT) \delta(t - kT) = x(t) \bullet \delta_T(t)$$

Block diagram showing a Zero-Order Hold (ZOH) system. The input is a discrete signal  $x^*(t)$  with Laplace transform  $X^*(s)$ . The system is a box labeled "ZOH". The output is a continuous signal  $x_e(t)$  with Laplace transform  $X_e(s)$ .

$$\mathcal{L}[x^*(t)] = \int_0^{+\infty} \sum_{k=0}^{+\infty} x(kT) \delta(t-kT) e^{-st} dt$$

$$= \sum_{k=0}^{+\infty} x(kT) e^{-kTs} = X^*(s)$$

$$X^*(s) = \sum_{k=0}^{+\infty} x(kT) e^{-kTs}$$

$$Z[X(kT)] = X(z) = \sum_{k=0}^{+\infty} x(kT) z^{-k}$$

$z = e^{sT}$

$$Z[X(kT)] = X(z) \xleftrightarrow{z = e^{sT}} X^*(s) = \mathcal{L}[x(t) \cdot \delta_T(t)]$$

$$\begin{array}{ccc}
 \text{TC} & X^*(s) \equiv X(z) & \text{TD} \\
 e^{j\theta} = \cos\theta + j\sin\theta & e^{sT} = z & s, z \in \mathbb{C} \\
 & & s = \sigma + j\omega \\
 e^{sT} = e^{\sigma T} \cdot \boxed{e^{j\omega T}} & & \\
 e^{j\omega T} = e^{j(\omega + 2\pi)T} & & 
 \end{array}$$

